Impact of Exchange Rate and Customs Union on Trade Balance of Turkey with EU (15)

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Abstract

*This paper investigates the short-run and long-run impact of real exchange rate changes and Customs Union (CU) agreement on the trade balance of Turkey with European Union (15) countries (EU (15))***.** *In the estimation procedure, the bounds testing approach to the cointegration and the error correction modeling is employed. Unlike the previous papers utilizing this approach, however, we adopt a new strategy in the model selection phase that ensures the selection of a statistically reliable and cointegrated model as the optimal model for estimation. Estimation results based on the quarterly data for 1982-I to 2001-IV period indicate no evidence of J-curve effect and no significant effect of customs union in the short run. In the long run, only domestic income variable has significant and expected negative effect and neither exchange rate nor customs union has any significant effect on the trade balance of Turkey with EU (15).*

Keywords: J-curve, Customs Union, Bounds Testing Approach, Depreciation

JEL Classification: F14, F31

1. Introduction

Currency depreciation or devaluation can generate both the effect of an export promoting policy such as export subsidies by making exports cheaper for foreigners and the effect of an import restricting policy such as tariffs by making imports more expensive for that country, thus resulting in an improvement in the trade balance. The condition under which currency depreciation will lead to the improvement of the trade balance is known as Marshall-Lerner condition.[1] Initially, economists empirically investigated the impact on trade balance of the currency depreciation by examining whether Marshall-Lerner condition was satisfied or not. Examples of this type of research include Kreinin (1967), Khan (1974) and Warner and Kreinin (1983). After the introduction of J-curve phenomenon by Magee (1973) and the realization that looking at this condition is an indirect way and takes into consideration only the long run, researchers begun to relate the trade balance directly to exchange rate, in addition to some other variables. Early studies of this type of work such as Bahmani-Oskooee (1985) and Marwah and Klein (1996) were, however, criticized on the basis of having used non-stationary data, which could result in the spurious-regression problem. Later studies such as Wilson (2001) and Lal and Lowinger (2002) took this potential problem associated with non-stationary data into account and employed appropriate methods.[2]

One of econometric techniques commonly used in the investigation of the effect of currency depreciation on trade balance is the bounds testing approach to the cointegration and the error correction modeling recently developed by Peseran *et al*. (2001). It is widely employed due to the following advantages it offers; i) Unlike other cointegration techniques such as Engle-Granger (1987) and Johansen-Juselius (1990) methods, the bounds testing approach can be applied regardless of whether model variables have the same order of integration or not, ii) It has better small sample properties (Mah 2002), iii) Short-run and long-run parameters of the model can be estimated simultaneously. Arora *et al*. (2003), Bahmani-Oskooee and Goswami (2003) and Bahmani-Oskooee and Ratha (2004b) are examples to those studies that have utilized this approach. The papers that have employed the bounds testing approach first select the optimal model using a certain model selection criterion such as Akaike Information Criterion (AIC) and then apply the cointegration and diagnostic tests to the selected model.

[1] Marshall-Lerner condition states that in order for devaluation to improve the trade balance, the sum of export demand and import demand elasticites must exceed one in absolute value.

[2] For a more detailed review of the relevant studies, see Bahmani-Oskooee and Ratha (2004a).

Whatever results come up regarding the cointegration and diagnostics are reported in the end. However, some or all of the diagnostics may not be satisfied and/or cointegration may not exist in the selected model, thus making the reported model unreliable. In this paper we follow a new strategy in the model selection phase. Specifically, we first apply the cointegration and diagnostic tests to all possible models, given a maximum lag length, and then determine the subset of models satisfying both the cointegration and the diagnostics. Finally, we apply model selection criterion to this subset in order to come up with the optimal model for estimation. Unlike the previous work, our strategy of model selection ensures that the estimated optimal model is co-integrated and passes the diagnostics, thus enabling us to have reliable statistical inferences from the estimated model.

The purpose of this paper is to examine the impact of currency depreciation and customs union on the trade balance of Turkey with EU (15) countries using bounds testing approach with the new strategy in the model selection phase we propose incorporated. The effect of exchange rate changes on Turkish trade balance is considered in the literature in a few papers. Brada *et al*. (1997) and Akbostanci (2004) are two such papers. In these papers, however, as trading partner of Turkey, the world is considered, not EU (15) countries. They don't consider the effect of customs union agreement, either. Effect of Turkey's customs union agreement with EU countries is investigated in the context of the effect on export and import demand functions in some other papers. For example, Neyapti *et al.* (2007) shows that the customs union agreement has positively impacted exports and imports of Turkey and led to changes in the responsiveness of both exports and imports to underlying variables.

The rest of the paper is organized as follows; in the following section the model employed in the estimation of the trade balance is set out, then the sources of data used in the estimation are described, the next section presents the empirical results obtained, and the last section contains the key findings and the concluding remarks.

2. Model

The way trade balance is modeled is well established in the literature and it is specified as a function of the real domestic income, the real foreign income, and the real exchange rate. The reduced form of the trade balance equation is given as follows;

$$\ln TB_t = a + b \ln Y_{TR,t} + c \ln Y_{EU,t} + d \ln RER_t + eD_t + \varepsilon_t \qquad (1)$$

Where TB is the trade balance defined as the ratio of exports of Turkey to EU(15) countries over Turkey's imports from the same group of countries, Y_{TR} is Turkey's real income, Y_{EU} is the real income of EU(15) countries constructed as the weighted average of real income of these countries where weights are assigned based on each country's share in Turkey's trade, RER is the real effective exchange rate between Turkey and currencies of EU(15) countries where nominal exchange rate is defined as the amount of Turkish Lira per trading partner's currency and D is the dummy variable for customs union, which takes on value 0 for quarters prior to the first quarter of 1996 and value 1 afterwards, given the fact that Turkey joined the Customs Union with EU in January of 1996.

Given the fact that an increase in real domestic income will stimulate the imports from abroad, the domestic income is expected to affect the trade balance negatively and therefore to have a negative coefficient. If, on the other hand, the increase in the domestic income results from an increase in the production of import-substitutes, the impact on the trade balance of the domestic income will be positive. By similar reasoning, an increase in the trading partner's real income will increase the exports and therefore the trade balance will improve. As in the case of domestic income, however, if the rise in the partner's income is due to the increase in the production of its import-substitutes, the effect of the trading partner's income on the trade balance will be negative. As for the effect of the real exchange rate, given the fact that the exchange rate is defined as the amount of domestic currency per foreign currency, a rise in the real exchange rate (depreciation) will lead to an improvement in the trade balance by making the exports cheaper for foreigners and imports more expensive for that country, thus yielding a positive coefficient.

Model in equation (1) represents the long-run relationship among the variables. Our interest, however, is not only in long-run effect on the trade balance of exchange rate changes and customs union but also in the short run impact. Therefore, the short-run dynamics need to be incorporated into equation (1). We do this, following Peseran *et al*. (2001), by employing Autoregressive Distributed Lag Method (ARDL). In this case, Equation (1) is expressed in error-correction modeling format as follows;

$$\Delta \ln TB_t = \alpha + \sum_{j=0}^{k} \beta_j \Delta \ln Y_{TR,t-j} + \sum_{j=0}^{l} \gamma_j \Delta \ln Y_{EU,t-j} + \sum_{j=0}^{m} \lambda_j \Delta \ln RER_{t-j} + \sum_{j=1}^{n} \theta_j \Delta \ln TB_{t-j}$$

$$+ \delta_1 \ln Y_{TR,t-1} + \delta_2 \ln Y_{EU,t-1} + \delta_3 \ln RER_{t-1} + \delta_4 \ln TB_{t-1} + \delta_5 D_t + u_t \qquad (2)$$

In the bounds testing approach cointegration among the model variables is established using F-test. The null hypothesis of no cointegration ($H_0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$) is tested against the alternative of cointegration ($H_1 : \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$). Under the assumption of the null hypothesis, the distribution of F-statistic, however, is non-standard. Therefore, in testing the above hypothesis we use new critical values provided by Peseran *et al*. (2001).[3] If the calculated F-statistic exceeds the upper bound critical value, we reject the null hypothesis and conclude that variables are cointegrated.

3. Data Description

The frequency of the data is quarterly and it covers the period from 1982:I to 2001:IV. All data are indexed using 2000 quarterly average as the base and also they all are seasonally adjusted. We have obtained them from four sources; IMF-IFS Country Tables, Eurostat, Central Bank of Turkey and Statistics Office of Turkey. Data for export and import values are taken from Statistics Office of Turkey. Data for Gross Domestic Product (GDP), Industrial Production Index, GDP Deflator and Consumer Price Index (CPI), except for Greek CPI, are compiled from IMF-IFS Country tables. Source for CPI of Greece is Eurostat. Data for the bilateral nominal exchange rate between Turkish Lira and the currency of each of the EU (15) countries except for Finland, Greece, Ireland, Portugal and Spain are obtained from Central Bank of Turkey. The source for bilateral nominal exchange rates between Turkish Lira and the currency of Finland, Greece, Ireland, Portugal and Spain is Eurostat. Bilateral exchange rates between Turkish Lira and the currency of each of these countries are not, however, directly available in Eurostat. We have calculated them using the exchange rate between the currency of each country and ECU, the exchange rate between US dollar and ECU and the exchange rate between Turkish Lira and US dollar.

4. Estimation Results

Before proceeding to the estimation, we have checked the integrating properties of variables involved using Augmented Dicky-Fuller (ADF) (1979) test. Because bounds testing approach, unlike two-step residual based approach of Engle-Granger (1987) and system-based reduced rank approach of Johansen and Juselius (1990), does not require that all variables have the same order of integration, one might be tempted to conclude that no unit-root testing is needed. However, since the distribution of F-statistic used for cointegration test is derived under the assumption that integration order of variables is either I(1) or I(0) or in between, unit-root testing is required to make sure that integration order of variables is not greater than one. ADF unit-root test is used for this purpose and results are reported in Table 1. Results indicate that all variables become stationary after being differenced once. Thus, all have an order of integration one, fulfilling the requirement that no variable has an order of integration greater than one.

Insert table (1) about here

In the present paper, we follow a new strategy in finding the model for the estimation. We believe that in order for inferences to be statistically reliable and therefore meaningful, the estimated model, from which test statistics for inferences are obtained, must well behave, i.e. it must satisfy basic assumptions of OLS. For this reason, given a maximum lag length, which is determined based on sample size, first those lag combinations that satisfy basic assumptions at a reasonably acceptable significance level (we set it at 10%) are detected. And then for each of these selected lag combinations, using the F-test, it is checked whether there exists a cointegration among model variables or not. If there is at least one combination for which there exists cointegration, it is concluded that there is a long run relationship among the model variables.

Once cointegration is established according to above procedure, the next step is to estimate the error correction model in (2). The question of which lag combination to use for estimation, i.e. optimal model, however, has to be settled. Here we employ AIC. The optimal model is selected by applying AIC to the set of those lag combinations that both satisfy diagnostics and indicate a cointegration. An algorithm developed by the second author is used to settle the issues mentioned above.

[3] The upper bound critical value for the F-statistic at 10% significance level is 3.77, taken from Peseran *et al*. (2001) (Table CI, Case III, p.300).

First, the maximum lag length on each first-differenced variable in equation (2) is set as 5. The model corresponding to each possible lag combination has been estimated and then those combinations that satisfy the diagnostic tests of normality, no serial correlation and no heterescodasticty at least at 10 % level have been selected. For each of these selected combinations, it is checked whether there exists a cointegration or not. In case no cointegration is established for a combination, that combination is discarded. Then, in order to determine the optimal model, AIC has been applied to the set of those lag combinations that satisfy diagnostic tests at least at 10 % level and at the same time indicate a cointegration. Having followed this procedure, we have come up with the optimal lag combination of (k=1, l=0, m=2, n=2).[4] The model in equation (2) corresponding to this lag combination has been estimated using OLS method based on the quarterly data covering the period of 1982:I – 2001:IV. Estimation results are given in Table 2.

Insert table (2) about here

Short-run impact of the exchange rate on the trade balance is inferred from the coefficients of the first-differenced exchange rate variable. Note that none of the exchange rate coefficients is significant. This means that the exchange rate does not matter in the short run in Turkey's trade with EU (15) countries. As a short-run phenomenon, we are particularly interested whether or not J-curve effect exists. Given the fact that the exchange rate is defined in such a way that a rise in the exchange rate represents the depreciation or devaluation of Turkish Lira, J-curve effect will be observed if the coefficient of the first-differenced exchange rate variable has first negative values and then positive ones. Looking at the Table 2 reveals that there is no such a pattern. This means that in Turkey's trade with EU (15) countries no evidence is found supporting the J-curve phenomenon. As far as the short-run effects of domestic and foreign incomes are concerned, only domestic income has a significant impact on the trade balance in the short run. As for the long-run effect, long-run coefficients are derived from short run estimates by dividing the coefficient of each lagged independent variable in equation (2) by the coefficient of the lagged dependent variable and multiplying with a negative sign. The resulting long-run estimates are reported in Table 3.

Insert table (3) about here

From this table we see that the real exchange rate variable does not carry a significant coefficient, implying that changes in the exchange rate do not affect Turkey's trade balance with EU(15) countries in the long run. This means that exchange rate policy can't be used effectively to improve the trade balance with this group of countries. The fight with inflation, which will result in real depreciation of Turkish lira, will not be helpful in improving the trade balance, either. As for incomes, only domestic income, not EU (15) income, matters. Not surprisingly, domestic income affects the trade balance negatively. As Turkish economy grows, its trade balance will worsen. Given the income elasticity of –1.047, for every one percent growth, trade balance will deteriorate by 1.047%. In order to reduce negative impact on the trade balance of economic growth, domestic industries can be encouraged to use less imported inputs and more domestic resources.

With regard to the effect of joining customs union with EU (15) countries, the dummy variable representing the customs union has neither in the short run nor in the long run a statistically significant coefficient. This implies that Turkey's participation in the customs union has not significantly affected its trade balance, at least during the period this study covers. This result is not surprising and can be explained in light of two facts. First, in 1970 with a protocol to the Treaty of Ankara signed in 1963, Turkish goods were allowed to enter European Union free of any restrictions, long time before customs union agreement in 1996. For this reason Turkish exports should not be expected to respond significantly to the joining of customs union in 1996. Second, Turkey's imports consist mainly inputs used in the production.[5] To continue to grow, Turkey has to import those inputs. This nature of Turkey's import structure implies that Turkey has to continue importing regardless of whether there is a customs union agreement or not. Therefore, imports should not be expected to respond significantly to the customs union agreement, either. As a result of these two reasons, customs union should not significantly affect Turkey's trade balance

To find out if there is any other cointegrating relationship among the variables of the model, equation (2) is reestimated by treating each one of explanatory variables as dependent variable. Calculated F-statistics obtained in each case by imposing maximum lag length 5 are reported in Table 4. Results indicate that calculated F-statistic values when each one of explanatory variable in equation (2) is taken as dependent variable are smaller than the upper bound critical value.

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[4] The lag combination picked up when the strategy of previous literature is adopted is (1, 0, 0, 2). In this case, however, normality assumption fails.

[5] According to data from Statistics Office of Turkey (www.tuik.gov.tr), for example, in 2008 imports of raw materials, intermediate goods and investment goods (179.8 billion dollars) constituted 89% of total imports of Turkey (201.9 billion dollars).

This implies that there is only one long-run relationship in which the trade balance is the dependent variable.

Insert table (3) about here

4. Conclusion

This paper has investigated the impact of real exchange rate changes and the customs union on the trade balance of Turkey with EU (15) countries in the short run as well as in the long run based on the quarterly data over 1982:I-2001-IV period. In the estimation of the trade balance model, bounds testing approach is employed. Unlike the previous literature that has used this approach, however, we have adopted a new strategy in optimal model selection phase. Our strategy differs from the previous one in that it ensures the selection of a statistically reliable and cointegrated model as the optimal model for estimation.

Estimation results indicate that exchange rate variable does not matter in the short run for the trade balance of Turkey with EU (15) countries and the impact observed suggests that there is no j-curve effect. As for the customs union, it does not significantly affect the trade balance in the short run. As far as the long-run impact of the real depreciation of Turkish Lira is concerned, we see from the results that it is not a significant variable in the determination of the trade balance. Like the exchange rate, the customs union does not play a significant role in the long run, either. Among the other variables, only domestic income significantly affects Turkey's trade balance in the long run and its effect is, as expected, negative.

These results suggest that any policy that will result in real depreciation of Turkish Lira such as anti-inflationary policies or devaluation can't be used to improve Turkey's trade balance with EU (15). Another implication of the results found is that, given the negative and significant effect of domestic real income, policies that will encourage local firms to use less imported inputs and more domestic resources can be employed to help reduce the negative impact on the trade balance of economic growth.

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Table 1: Unit-Root Test Results

	ADF Statistics (levels)		ADF statistics (first differences)	
Variables	Without trend	With trend	Without trend	With trend
lnTB	-2.39 (4)	-3.23 (3)	-6.69 (1)*	-6.66 (1)*
$\ln Y_{TR}$	-2.29 (3)	-1.67 (2)	-6.35 (1)*	-6.91 (1)*
$\ln Y_{EU}$	-0.84 (2)	-1.69 (2)	-8.84 (1)*	-8.79 (1)*
lnRER	-2.55 (2)	-2.50 (2)	-4.45 (2)*	-5.16 (1)*

Note: * indicates significance at conventional 5% level.

Table 2: Short-Run Estimates and Diagnostic Tests

Dependent Variable: $\Delta \ln TB_t$

Regressors	**Coefficient**	**t-value**
Constant	-0.229***	-3.008
$\Delta \ln Y_{TR,t}$	-2.438***	-4.816
$\Delta \ln Y_{TR,t-1}$	-0.893	-1.651
$\Delta \ln Y_{EU,t}$	1.587	1.178
$\Delta \ln RER_t$	-0.038	-0.127
$\Delta \ln RER_{t-1}$	0.041	0.137
$\Delta \ln RER_{t-2}$	-0.333	-1.240
$\Delta \ln TB_{t-1}$	0.128	1.015
$\Delta \ln TB_{t-2}$	0.297**	2.504
D_t	-0.042	0.052
ECM^1_{t-1}	-0.472*	-4.267
Diagnostic Tests	**Value of Statistic**	**p-value**
Normality[2]	3.7	0.157
No Serial Correl.[3]	5.1	0.278
No Heteroscedas.[4]	2.1	0.143
F (Wald)[5]	4.504	

Notes: *, **, *** indicate significance levels at 10%, 5%, and 1%, respectively.
1. The upper bound critical value for t-statistic at 10% significance level is -3.46 (Peseran *et al.* (2001), Table CII, Case III, p.303) 2. Jarque-Bera: $\chi^2(2)$ 3. LM: $\chi^2(4)$ 4. LM: $\chi^2(1)$ 5. The upper bound critical value for F-statistic at 10% significance level is 3.77 (Peseran *et al*. (2001), Table CI, Case III, p.300).

Table 3: Long-Run Estimates

Dependent Variable: $\ln TB_t$

Regressors	Coefficient	t-value
Constant	-0.486**	-2.595
$\ln Y_{TR,t}$	-1.047***	-4.923
$\ln Y_{EU,t}$	0.885	1.585
$\ln RER_t$	0.213	0.220
D_t	-0.088	-0.312

Notes: *, **, *** indicate significance levels at 10%, 5%, and 1%, respectively.

Table 4: F-test Results for Cointegration

Dependent Variable	Calculated F-Statistic
lnTB	3.89*
$\ln Y_{TR}$	2.45
$\ln Y_{EU}$	1.23
lnRER	1.43

Notes: * indicates significance levels at 10%. The lag length is 5. The lower bound critical value for F-statistic at 10% significance level is 2.72 and the upper bound critical value for F-statistic at 10% significance level is 3.77 (Peseran *et al*. (2001), Table CI, Case III, p.300).